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Transperitoneal laparoscopic simple nephrectomy for giant hydronephrosis: Tips and tricks to make it easier

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Abstract

Purpose: We report our experience with transperitoneal laparoscopic nephrectomy (LN) for giant hydronephrosis (GH) and compare the outcome data with open nephrectomy (ON).

Patients and methods: The retrospective data of 88 patients (52 males and 36 females) who underwent LN or ON for treatment of GH in the period between October 2015 and December 2019 were investigated. LN was performed in 38 patients, while 50 patients underwent ON. We compared the two groups for success, operative time, and intraoperative and postoperative complications.

Results: The mean age of the patients in the LN group was 45.8 ± 11.4 years, and it was 44.7 ± 10.8 years in the ON group. The mean operative time in the LN group was statistically significantly longer when compared with the ON group195 ± 18 min versus 127 ± 22 min ($p = 0.01$).The estimated blood loss was significantly greater in the ON group ($p = 0.01$). However, no patients required blood transfusions in either group. The visual analog pain (VAP) scores were significantly higher on both day 1 and day 2 in the ON group 3.6 ± 0.9 and 2 ± 0.7 versus 2.7 ± 0.6 and 1.4 ± 0.5 in LN group, ($p = 0.01$).

Conclusion: LN for GH is feasible, safe, and efficacious. Compared to open surgery, the laparoscopic approach resulted in significantly shorter hospital stays, decreased morbidity, and quicker recovery. Some tips and tricks could help to do it in an easier way and reduce the operative time.

Keywords

Giant hydronephrosis, laparoscopic, nephrectomy, tips, non functioning

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Background

Laparoscopic surgery is the gold standard technique preferred for the treatment of kidney diseases. It is rapidly evolving due to the contribution of technological developments in minimally invasive surgery. The first laparoscopic (LN) was performed by Clayman et al.[1] in 1991 and since then, this procedure has increasingly been performed for the treatment of benign and most malignant renal diseases.[2]

Simple nephrectomy is the standard procedure for the removal of non-functioning benign kidneys. However, despite the word simple in its name, it can be a challenging procedure during laparoscopy when increased perirenal adhesions secondary to infectious processes exist.[3] Giant hydronephrosis (GH) is defined as a kidney containing more than 1 l of fluid in the collecting system. It is usually secondary to stones, ureteropelvic junction obstruction

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(UPJO), or congenital abnormality. These kidneys, which meet or cross the midline or occupy a hemi-abdomen, add difficulty during LN due to limited space and potentially dense adhesions around the kidney.[4] In the last decade, these challenging conditions were considered relative contraindications to laparoscopy.[5]

In this study, we retrospectively compared the records of simple transperitoneal LN versus open nephrectomy (ON) for GH.

Patients and methods

This retrospective study included patients who underwent simple nephrectomy at our institution in the period between October 2015 and December 2019. Patients considered for enrollment in the study were those who had undergone simple ON or simple transperitoneal LN for a nonfunctioning kidney with GH, which is defined as a kidney containing more than 1 l of fluid measured intra-operatively in the suction device or hydronephrosis crossing the midline in preoperative computed tomography (CT). Patients were excluded if they had any of the following criteria: (1) renal tumors for which nephrectomy was indicated; (2) patients with previous open renal surgery; and (3) pediatric age group.

Preoperative work up

All patients were subjected to complete history taking, physical examination, urine culture and sensitivity test, kidney function tests, abdomino-pelvic ultrasound, DTPA study, and CT urogram.

Surgical indication

Patients have nonfunctioning kidneys with GH secondary to UPJO, stones, ureteric stricture, or infection.

Transperitoneal LN procedure

After documentation of informed consent for the procedure with the possibility of open conversion explained, the procedure was performed under general anesthesia. Antibiotic was administered during induction of anesthesia, a Foley catheter was introduced, and an orogastric tube was placed for all patients. Patients were placed in a 60° lateral position with the diseased side facing up.

Under ultrasonic guidance, a Chiba needle was introduced into the kidney to aspirate about 500 cc of fluid from the hydronephrotic kidney, and pneumo-peritoneum was achieved using a Veress needle. A Visiport was introduced at the level of the umbilicus and lateral to the rectus muscle, and care was taken to avoid entrance into the hydronephrotic kidney; this trocar was used as a camera port. For the right-side nephrectomy a 12 mm trocar was introduced below the costal margin at the mid-clavicular line, while a 5 mm trocar was introduced close to the iliac crest at the midclavicular line.For the left-side nephrectomy, a 5 mm trocar was introduced below the costal margin at the mid-clavicular line, and a 12 mm trocar was introduced close to the iliac crest at the mid-clavicular line. Another 5 mm trocar was introduced at the anterior axillary line at the level of the camera port; this port helps in traction on the renal sac during the procedure. For right-sided procedures, retraction of the liver to improve the visualization of the renal hilum is done by atraumatic grasper placed through an extra 5-mm port. Initially, the colon was mobilized medially then the ureter, gonadal vessels were identified below the level of the lower pole of the kidney. Then, the lower pole of the kidney was mobilized and left up with the left hand antro-laterally towards the anterior abdominal wall while dissection was continued upwards using Harmonic Ace (Ethicon Endo-Surgery, Cincinnati, OH, USA) where both the renal artery and vein were carefully dissected. An EndoGIA laparoscopic stapler (Ethicon Echelon 60 Endoscopic Linear Cutter) was introduced through the 12 mm port where both the artery and the vein were controlled using the stapler. The rest of the kidney was then mobilized completely through both sharp and blunt dissection. After complete mobilization of the kidney, a small incision was made at the thin cortical area on the lateral border of the kidney where the suction tube was introduced into the kidney to aspirate all renal fluid. At this point, the kidney was shrunken and folded on itself and a specimen retrieval bag was introduced through the 12 mm port, and the kidney was kept in to be delivered through extended 12 mm port incision. Complete hemostasis was confirmed. All ports were removed under direct vision and closed in the regular using the stapler fashion, the site of renal extraction closed, and a tube drain was placed and left for 48 h.

Simple ON

All patients received general anesthesia and were placed in the lateral position with the affected side facing upward. The kidney rest was elevated and the table was flexed. An eleventh rib cutting incision was made. The muscle layers of the posterior abdominal wall were incised and the retroperitoneal space was entered.

Gerota's fascia was identified and opened, and the ureter was identified, transected, and ligated with 1/0 silk. The renal hilum was dissected, and the renal artery was identified, doubly ligated with 2/0 silk, and divided; the renal vein was also identified, doubly ligated with 2/0 silk, and divided. The kidney was released from its other attachments, the specimen was removed, hemostasis was achieved, and a drain was placed. The incision was closed

Table 1. Pre-operative data in both groups.

Preoperative data		LN Group ($n=38$)	ON group ($n=50$)	p-Value
Age (years)	Mean ± SD	45.8 ± 11.4	44.7 ± 10.8	0.6
Sex (No. (%))	Male	20 (52.6%)	32 (64%)	0.3
	Female	18 (47.4%)	18 (36%)	
BMI (points)	Mean ± SD	20.2 ± 1.8	20.9 ± 2.2	0.08
BMI category	Underweight	8 (21.1%)	4 (8%)	0.1
	Normal weight	29 (76.3%)	43 (86%)	
	Overweight	1 (2.6%)	3 (6%)	
Pre-op. creat. (mg/dl)	Mean ± SD	1 ± 0.3	1 ± 0.4	0.5
Diabetic patients	Yes	8 (22.2%)	9 (18%)	0.6
Hypertension	Yes	7 (18.4%)	9 (18%)	0.9
Patients with kidneys crossing midline		8 (22.2%)	4 (8%)	0.1
Cause of obstruction	UPJO	13 (34.2%)	12 (24%)	0.4
	Ureteric stricture	10 (26.3%)	19 (38%)	
	Stone	15 (39.5%)	19 (38%)	

in the regular fashion using 1 vicryl suture for muscle and 2/0 ethilon for skin.

Operative time, estimated blood loss, access-related injury, and conversion to open surgery in the laparoscopy group were recorded. Postoperative data, such as postoperative development of ileus, degree of postoperative pain according to the visual analog pain (VAP) score, and length of hospital stay were also reported.

Statistical analysis

Data were statistically described in terms of mean ± standard deviation (±SD), median and range, or frequencies (number of cases) and percentages when appropriate. For comparing categorical data, Chi square (c2) test was performed, Fisher Exact test was used instead when the expected frequency is less than five counts. Comparison of numerical variables between the study groups was done using Mann Whitney *U* test for independent samples when comparing two groups and Kruskal Wallis test when comparing more than two groups. All statistical calculations except for power of the study were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Results

This retrospective study included 88 patients who underwent simple nephrectomy in the period between October 2015 and December 2019. Of these 38 patients underwent simple LN (Figures 1 and 2) and 50 patients underwent simple ON. However, four patients (10.5%) required conversion to open surgery due to extensive perirenal adhesions as those patients had secondary pyonephrosis due to multiple renal stones.

The demographic characteristics of the study groups are shown in Table 1. The mean age of the patients in the LN group was 45.8 ± 11.4 years, and in the ON group it was 44.7 ± 10.8 years.

There was no statistically significant difference between the two groups with regard to age, gender, and mean body mass index. Also, there were no statistically significant differences regarding patient comorbidities, baseline creatinine, and different causes of renal parenchymal loss.

The patients' intraoperative and postoperative data are summarized in Table 2. There were no statistically significant differences regarding the distribution of side of operation or the amount of aspirated fluid from the kidney during operation.

The mean operative time in the LN group was statistically significantly longer when compared with the ON group ($p=0.01$). The estimated blood loss was significantly greater in the ON group ($p=0.01$). However, no patients required blood transfusions in either group. There were no major intraoperative complications (grade 4 or 5) according to Clavien-Dindo classification system. The only intraoperative complication was access injury to the kidney in 1 (2.6%) patient, but the procedure was completed laparoscopically in all of them.VAP scores were significantly higher on both day 1 and day 2 in the ON group ($p=0.01$). Time to oral allowance and hospitalization time were higher in the ON group than in the LN group ($p=0.01$). Incisional hernia (grade IIIB according to Clavien-Dindo classification system) was reported in 5 (10%) patients in the ON group compared to zero patients in the LN group ($p=0.01$). Prolonged ileus (grade I according to Clavien-Dindo classification system) was reported in two patients (5.3%) and four patients (8%) in the LN and ON groups, respectively; there was no statistically significant difference with regard to prolonged ileus ($p=0.6$) (Figures 1 and 2).

Table 2. Intraoepratvie data, complications, and post operative data in both study groups.

	LN group ($n=38$)	ON group ($n=50$)	p-Value
Intraoperative data			
Side of operation			
Right	21 (55.3%)	32 (64%)	0.4
Left	17 (44.7%)	18 (36%)	
OR time (min)			
Mean ± SD	195 ± 18	127 ± 22	0.01*
Fluid aspirated (ml)			
Mean ± SD	1733 ± 370	1777 ± 424	0.6
EBL (ml)			
Mean ± SD	129 ± 30	222 ± 45	0.01*
Intraoperative complications			
Access injury			
Yes	1 (2.6%)	–	–
Conversion to open			
Yes	4 (10.5%)	–	–
Postoperative data			
VAP Pain day 1 (points)			
Mean ± SD	2.7 ± 0.6	3.6 ± 0.9	0.01*
VAP Pain day 2 (points)			
Mean ± SD	1.4 ± 0.5	2 ± 0.7	0.01*
Prolonged ileus			
Yes	2 (5.3%)	4 (8%)	0.6
Time to oral intake (h)			
Mean ± SD	23 ± 9.2	31 ± 8.6	0.01*
LOS (days)			
Mean ± SD	2.3 ± 0.6	2.9 ± 0.9	0.01*
Post-op. creat. (mg/dl)			
Mean ± SD	1 ± 0.3	1 ± 0.3	0.2
Incisional hernia			
Yes	0 (0%)	5 (10%)	0.05*

*Statistically significant difference when $p < 0.05$.

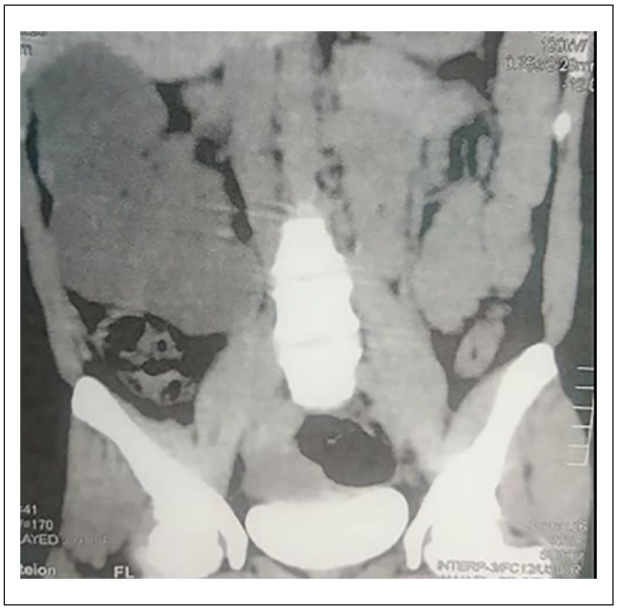

Figure 1.

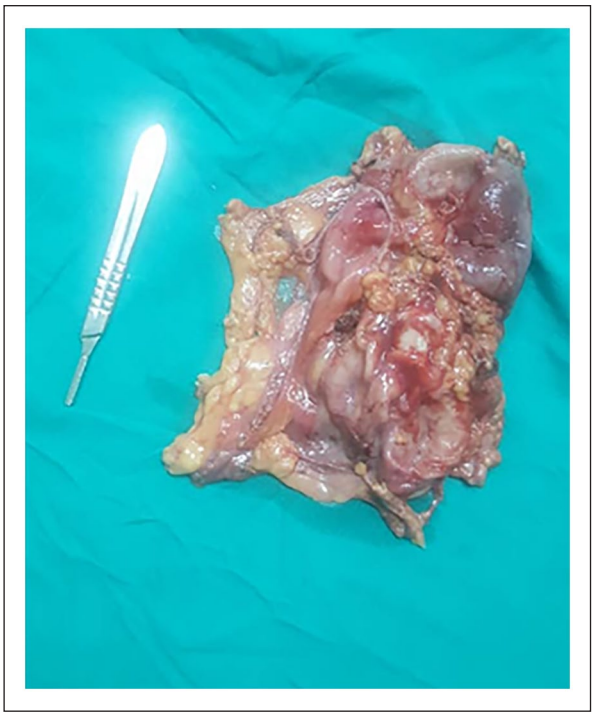

Figure 2.

Discussion

Radiologically, GH appears as a kidney that meets or crosses the midline, extends more than five vertebral lengths, or occupies ahemi-abdomen.[6] It can be defined as a kidney containing more than 1 l of fluid in the collecting system.[7] UPJO, which accounts for 80% of cases is the most common cause of GH.[6,7] Patients may present with hematuria, an abdominal mass, recurrent urinary tract infections, and flank pain. In cases of bilateral obstruction, uremia may be the presenting symptom.[8]

Most of these kidneys are nonfunctioning and require nephrectomy as the treatment of choice. However, nephrectomy may not be performed in patients with a solitary kidney or patients with bilateral pathology. Clayman et al.[1] performed the first LN in 1991; since then, laparoscopy has become widely used in nephrectomy procedures.

In this study, we retrospectively reviewed and compared patients with GH who underwent LN versus ON.

GH represents a challenge during laparoscopic procedures because the huge size of the kidney may fill most of the abdominal cavity and allow limited working space. Additionally, incidental renal puncture may occur during insertion of the first port. To avoid renal puncture with the first trocar and to offer a wider working space during the procedure, we start the operation by placing a Chiba needle at the renal angle and aspirating some renal fluid (usually 500 cc).This decreases the incidence of renal puncture and at the same time maintains the contour of the kidney intact and enables better laparoscopic dissection.

Another challenge for LN in GH is difficulty in handling and retracting the kidney. In our technique, a 5 mm port is placed laterally at the anterior axillary line. This port helps with retraction during dissection and in holding the renal sac laterally after evacuation of all renal fluid. The 5 mm laterally placed port holds the folded renal tissue after aspiration of all renal fluid and lifts the specimen up, which in turn allows easier placement of the EndoGIA stapler to control the renal pedicle.

Operative time was significantly longer in the LN group compared to the ON group (195 ± 18 min vs 127 ± 22 min, $p = 0.01$).For the ON group, the time to oral intake was 31 ± 8.6 h compared to 23 ± 9.2 h for the LN group ($p = 0.01$). Shiff and Glazier[9] reported a delay for oral intake of up to 72 h in the ON group. Hemal et al.[10] reported early oral intake in the first 24 h in patients who underwent LN.

In this study, the average length of hospital stay was 2.3 ± 0.6 days in the LN group compared to 2.9 ± 0.9 days in the ON group ($p = 0.01$). Schiff and Glazier[9] reported a hospital stay range from 6.9 to 10.5 days in ON cases, while Hemal et al.[10] reported a mean hospital stay of 2–3 days in the LN group.

In the present study, access-related injuries were reported in one patient in the LN group (2.6% of cases). There was incidental puncture of the renal sac during placement of the first port, and the procedures were completed through the laparoscopic approach. Karuppiah et al.[11] reported (3 out of 25 patients, 12%) in their study.

In the current study, partial percutaneous decompression using a Chiba needle was performed at the beginning of the procedure and before insertion of the first trocar. Partial aspiration of some fluids from the kidney (about 500 cc) facilitated placement of the first trocar and to avoid puncture of the renal sac. Meanwhile, removing this amount of renal fluid did not disturb the contour of the kidney and did not affect laparoscopic dissection of the renal sac. In a different approach, Hemal et al.[10] used a Veress needle to percutaneously decompress the kidney after initial dissection was completed.

En bloc renal pedicle control with an endovascular stapler was used in this study. We believe that laparoscopic endovascular control of the renal pedicle for GH facilitates the procedure.

Important and critical steps should be followed before applying the endovascular stapler. After colon mobilization, the lower pole of the kidney is dissected and lifted up for further exposure of the psoas muscle, and dissection is carried out posteriorly until the lower edge of the renal hilum is exposed. Attention is then directed towards the upper pole of the kidney and directed down to the renal hilum. The dissection is then directed posteriorly to expose the psoas muscle. After complete exposure of the renal pedicle, the endovascular stapler is applied. Ma et al.[12] used a laparoscopic endovascular stapler to control the renal pedicle and demonstrated the safety of this technique and satisfactory outcome of the procedure.

In the current study, four patients (10.5%) in the laparoscopy group were converted to ON secondary to extensive adhesions around the medial border of the kidney that prevented a safe laparoscopic procedure. Karuppiah et al.[11] reported conversion to ON in 4 out of 24 patients in their study, and Eraky et al. reported 9 cases converted to ON out of 106 patients.[10,13]

This study was performed on a relatively large number of patients with giant hydronephrosis. Its outcome is consistent with previous research regarding postoperative pain, our study reported significantly lower VAP scores in the LN group compared to the ON group.

Study limitations

This study has some limitations, it is a retrospective study which is subject to selection bias. Randomized prospective larger series are necessary to confirm the safety of LN for GH. The patient number could have been larger so, detailed subgroup analysis could be done.

Conclusion

We conclude that LN for GH is a feasible and safe procedure. However, we recommend the following steps during the procedure: First, aspiration of 400–500 cc of renal fluid before starting the procedure will decrease the chance of renal sac puncture during placement of the first port; second, placement of a 5 mm port at the anterior axillary line will help in retracting and handling the folded renal sac after aspiration of its contents; and third, using a laparoscopic EndoGIA stapler facilitates renal pedicle control in GH and reduces operative time.

Author contributions

A. I. Ali: project development; E. M. Galal: Data collection management; M. F. Rohiem: Data collection and management; A. M. Fawzy: Data analysis; M. M. Abdelghani: Data management; A. Eldakhakhny: Manuscript editing; A. Hassan: Manuscript writing; Ehab M. Galal: Helped in writing the manuscript.

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Research involving human participants

Yes

Informed consent

Was taken from all patients in the study

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References

1. Clayman RV, Kavoussi LR, Soper NJ, et al. Laparoscopic nephrectomy: initial case report. *Urol J* 2017; 197(2S): S182–S6.
2. Fornara P, Doehn C, Friedrich H-J, et al. Nonrandomized comparison of open flank versus laparoscopic nephrectomy in 249 patients with benign renal disease. *Eur Urol* 2001; 40(1): 24–31.
3. Yucel C, Ulker V, Kisa E, et al. Laparoscopic transperitoneal nephrectomy in non-functioning severe hydronephrotic kidneys with or without renal stone. *Cureus* 2018; 10(12): e3729.
4. Kaya C, Pirincci N and Karaman MI. A rare case of an adult giant hydroureteronephrosis due to ureterovesical stricture presenting as a palpable abdominal mass. *Int Urol Nephrol* 2005; 37(4): 681–683.
5. Valla J-S. Retroperitoneoscopic surgery in children. In: Ostlie DJ (ed.) *Semin in pediatric surgery*. WB Saunders, 2007, pp.270–277.
6. Friedland GW, Devries PA and Nino-Murcia M. Clinical urography: an atlas and text book of urologic imaging. *Congenit Anom Urin Tract* 1990; 1990: 559–787.
7. Crooks KK, Hendren WH and Pfister RC. Giant hydronephrosis in children. *J Pediatr Surg* 1979; 14(6): 844–850.
8. Yang WT and Metreweli C. Giant hydronephrosis in adults: the great mimic. Early diagnosis with ultrasound. *Postgrad Med J* 1995; 71(837): 409–412.
9. Schiff M and Glazier WB. Nephrectomy: indications and complications in 347 patients. *Urol J* 1977; 118(6): 930–931.
10. Hemal AK, Wadhwa SN, Kumar M, et al. Transperitoneal and retroperitoneal laparoscopic nephrectomy for giant hydronephrosis. *Urol J* 1999; 162(1): 35–39.
11. Karuppiah PB, Venkatachalam TP, Ponnusamy P, et al. Transperitoneal laparoscopic versus open nephrectomy for benign non functioning kidneys: a comparative study. *J Evol Med Dent Sci* 2015; 4(91): 15648–15656.
12. Eraky I, El-Kappany HA and Ghoneim MA. Laparoscopic nephrectomy: Mansoura experience with 106 case. *BJUI* March 1995, https://doi.org/10.1111/j.1464-410X.1995.tb07336
13. Parra RO, Hagood PG, Boullier JA, et al. Complications of laparoscopic urological surgery: experience at St. Louis University. *Urol J* 1994; 151(3): 681–684.